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RANGE MANAGEMENT SYMPOSIUM

July 28-30, 1964

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PREFACE

This report has been especially prepared from material presented at the Crested Wheatgrass Symposium at Burns, Oregon, July 28, 29 and 30, 1964.

It summarizes a wide variety of results from field research conducted in Idaho, Nevada, Oregon and Utah, with major emphasis on these findings, together with a collection of selected opinions which resulted from the free interchange of ideas developed through informal discussion sessions.

Included also are notes comparing Standard and Fairway wheatgrass taken from early Russian experimentations and from a later Russian work dealing with Imbricated wheatgrass; summaries of D. N. Hyder and Forrest A. Sneva's work on morphological and physiological factors affecting the grazing management of crested wheatgrass; plus Neil C. Frischknecht's research dealing with big sagebrush and rubber rabbitbrush on production of crested wheatgrass.

The entire proceedings are expertly condensed into an excellent summary by Dillard H. Gates, Range Management Specialist, Oregon State University.

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A G E N D A

BUREAU OF LAND MANAGEMENT
Oregon State Office

SYMPOSIUM ON MANAGEMENT OF CRESTED WHEATGRASS

Burns, Oregon
July 28 - 30, 1964

July 28 Afternoon 1:00 - 2:00	Garth H. Rudd, Assistant State Director, BIM, Oregon-Washington - Introductory Remarks
	Art Sawyer, Superintendent, Squaw Butte Experiment Station, ARS, Burns, Oregon - Discussion on the need for this symposium and the role of research.
	Howard DeLano, Chief Division of Range Management, BIM Oregon State Office - Statistics of the range seeding program on BLM lands.
2:00 - 3:00	Neil Frischknecht, Project Leader, Intermountain Forest and Range Experiment Station, USFS, Provo, Utah - Presentation of research concerning crested wheatgrass seeding and management.
3:00 - 3:30	Break
3:30 - 4:30	Discussion of Frischknecht's presentation.
July 28 Evening	Dr. Charles E. Poulton, Professor of Range Ecology, Oregon State University - Cooperation - it's place in range management.
July 29 Morning 8:00 - 9:00	Joe Robertson, Head Department of Range Management, University of Nevada, Reno, Nevada - Presentation of research concerning management of crested wheatgrass.
9:00 - 9:45	Discussion of Robertson's research.
9:45 - 10:15	Break
10:15 - 11:15	Lee Sharp, Associate Professor of Range Management, University of Idaho, Moscow, Idaho - Research on crested wheatgrass conducted in Idaho.
11:15 - 12:00	Discussion of Sharp's research.

July 29 Afternoon 1:15 - 2:15	Joe Mohan, Range Manager, Ochoco National Forest, Prineville, Oregon - Presentation of grazing management of crested wheatgrass at the Crooked River National Grasslands.
2:15 - 3:00	Discussion of Mohan's work.
3:00 - 3:30	Break
3:30 - 5:30	Resource panel consisting of the four previous speakers. This will be an opportunity for the panel to question one another and also for a free exchange of ideas and comments between participants in the seminar and the outside speakers.
July 30 Morning 8:00 - 9:00	E. William Anderson, State Range Management Specialist, Soil Conservation Service, Portland, Oregon - Presentation of range sites in Oregon.
9:00 - 10:00	Discussion of Anderson's presentation.
10:00 - 10:30	Break
10:30 to 12:00 1:00 - 3:00	Dillard H. Gates, Range Management Specialist, Oregon State University, Corvallis, Oregon - Discussion led by Gates of integrated grazing management of crested wheatgrass and overall management and planning. This will be primarily a review of material covered in the seminar and will attempt to tie together and show how this information can be integrated into range resource planning.

SYMPOSIUM ATTENDEES

Name	Title	Representing	Home Address
Don Kuizenga	Forester	USFS	Burns, Oregon
L. Christian Vosler	Range Manager	BLM	Burley, Idaho
Lee A. Sharp	Assoc. Professor Range Management	Univ. of Idaho	Moscow, Idaho
Delmar D. Vail	Ass't District Manager	BLM	Boise, Idaho
Charles L. Rants	Range Manager	BIA	Fort Hall, Idaho
Gerald E. Hillier	Range Manager	BLM	Prineville, Oregon
Donald Z. Robins	District Manager	BLM	Prineville, Oregon
Joe Mohan	Range Manager	USFS	Prineville, Oregon
Dillard H. Gates	Extension Range Specialist	OSU	Corvallis, Oregon
Chadwick McBurney	Range Manager	BLM	Vale, Oregon
Chester E. Conard	Ass't District Manager	BLM	Burns, Oregon
R. J. Raleigh	Assoc. Professor, Animal Nutrition	ARS-Squaw Butte	Burns, Oregon
Bud Rumberg	Agronomist	ARS-Squaw Butte	Burns, Oregon
Forrest A. Sneva	Range Conservationist	ARS-Squaw Butte	Burns, Oregon
Joe D. Wallace	Ass't Professor, Animal Science	ARS-Squaw Butte	Burns, Oregon
W. A. Sawyer	Superintendent	ARS-Squaw Butte	Burns, Oregon
Ray Novotny	County Extension Agent	OSU	Burns, Oregon
Jack McIntosh	District Manager	BLM	Baker, Oregon
Leo A. Moser	Range Manager	BLM	Baker, Oregon
Ed Spang	Ass't District Manager	BLM	Vale, Oregon
Max Lieurance	District Manager	BLM	Vale, Oregon
Reinard Okeson	Range Manager	BLM	Burns, Oregon
Reginald A. Ross	Range Conservationist	BLM	Vale, Oregon
Gene Nodine	Range Conservationist	BLM	Winemucca, Nevada
Paul M. Jenkins	Range Conservationist	BLM	Portland, Oregon
Carl McCrillis	Range Conservationist	BLM	Portland, Oregon
Neil Frischknecht	Project Leader	USFS	Provo, Utah
Floyd E. Kinsinger	Research Coordinator	BLM	Washington, D.C.
Howard S. Gebel, Jr.	Range Conservationist	BLM	Susanville, Calif.
C. E. Poulton	Professor of Range Management	OSU	Corvallis, Oregon
Garth H. Rudd	Ass't State Director	BLM	Portland, Oregon
Delbert Fallon	Range Conservationist	BLM	Boise, Idaho
Ross Ferris	Range Conservationist	BLM	Reno, Nevada
E. L. Woods	County Extension Agent	OSU	Prineville, Oregon
Willard Phillips	Range Manager	BLM	Burns, Oregon
Bob Sterling	County Extension Agent	OSU	Redmond, Oregon
Joe H. Robertson	Head, Division of Range Management	Univ. of Nevada	Reno, Nevada

Name	Title	Representing	Home Address
W. H. C. Schallig	Assistant in Range Management	OSU	Corvallis, Oregon
Lew Harris	Range Manager	BLM	Lakeview, Oregon
Alvin Steninger	Range Conservationist	BLM	Lakeview, Oregon
J. Kent Giles	District Manager	BLM	Burns, Oregon
Howard R. DeLano	Chief, Division of Range Management	BLM	Portland, Oregon
E. Wm. Anderson	State Range Management Specialist	SCS	Portland, Oregon
Jack Churchill	Cooperative Relations Specialist	BLM	Washington, D.C.
Dean Frischknecht	Animal Science Specialist	OSU	Corvallis, Oregon
William Moser	County Extension Agent	OSU	Lakeview, Oregon
Andy Parker	Range Conservationist	BLM	Lakeview, Oregon

INTRODUCTORY REMARKS

Garth H. Rudd

Bureau of Land Management
Portland, Oregon

It has been 66 years since crested wheatgrass was first introduced into this country - 1898 was the year. Russian Turkistan was the mother country. The first seed was soon dissipated in trials under unfavorable conditions.

The second shipment was received in 1906 from the same place. Little interest was shown in the grass until the drouth years of 1920-21. Then its survival, particularly in North Dakota when other grasses were being drouth-killed, attracted considerable interest, but it was not until 1929 that commercial seed became available.

The subject of this symposium is the management of crested wheatgrass. This is a most timely subject. In the Bureau, crested wheatgrass has been seeded in an effort to rehabilitate denuded lands, to restore an important natural resource. Comparatively large amounts of monies are being budgeted, appropriated and expended by BIM, other Federal agencies, as well as expenditures by private parties for seeding of crested wheatgrass. We have learned much about the technique of seeding this grass. We are perhaps not as well informed about the art of its management. I am sure, as a result of this meeting, with the technical competence of those assembled and with free exchange of knowledges and experiences, a long step forward will have been made in overcoming this deficiency.

It is important that we bring all available talents to bear on the subject. A few days ago Congressman Ullman, on the occasion of his visit to the Vale Project, was quoted as saying: "A lot of people do not know what is involved in a large scale land rehabilitation project such as this. We still do not have all the answers..." We hope that some of these answers will come from this conference.

Stoddart and Cook of Utah State University, in an article in the American Cattle Producer, estimated 25 to 50 million acres of land in the West can be profitably seeded to grass, one-half Federal lands and one-half private lands. This indicates the scope of the problem under discussion. It is important that all parties be kept equally informed about all aspects of crested wheatgrass and, particularly, its management.

It is important that users, managers, technicians and researchers work together on a common ground and for a common purpose. Confidence must be won and maintained. It seems particularly important for technicians and researchers to translate their knowledge so they can be understood by the public, users and resource managers. It is important that not only users of the resource be kept informed, but it is most essential that the general public be kept informed. This symposium offers an opportunity to provide such understandings. However, it is equally important that understandings and agreements reached here on the art of crested wheatgrass management be passed on to all other interested parties and where we still lack the answers, efforts need to be renewed to obtain them.

We appreciate the cooperation in helping to develop this symposium agenda. Thanks to each of you for being here. We look forward to your contribution.

WHY THIS SYMPOSIUM

W. A. Sawyer
Squaw Butte Experiment Station
Burns, Oregon

Biological Science is to some degree a mixture of science and art. The application of the science of range management involves more art than most of the agricultural sciences. Limited control of the multitude of factors involved in the use, improvement and management of range taxes heavily the artistic ability of the range manager. Webster defines an artist as "a practitioner, especially when proficient in any occupation requiring skill -- an artful person -- a schemer".

To become most proficient, as artists we must (1) possess scientific knowledge, and (2) have experience in the application of knowledge to the problems being worked upon.

This conference then should have as its major purpose the exchange or review of scientific information; and the exchange of experiences. In the latter area we will profit most by informal discussion as an aid in relating our experiences to applicable scientific information.

When our experiences are not oriented to, and backed up by scientific facts, they may easily be misinterpreted and wrongly used the next time we must draw upon those experiences.

This symposium is a useful tool for obtaining in summary form some of the later research information and for considering its application to our job of improving and managing range. Keeping up on the findings of research is becoming increasingly difficult. The library of the Squaw Butte Experiment Station is small (probably less than 100,000 scientific papers and publications). My staff spend several days of intensive library work reviewing the literature in a rather narrow field when developing plans for a research project. This is in addition to 15 or 20 percent of their regular time spent in reading. I am sure each of you could spend at least two hours of every day at library work and still not read the current literature of the world pertinent to range management, use and improvement. I would be surprised of you spend one-half hour per day in library work. This isn't being critical -- unless it is critical to point out to our administrative people that time budgets of field staff need to allow for more time for reading.

Periodic conferences of this type can serve as a partial substitute for some of the library work we need to do. The group discussion of this symposium can stimulate our capacity to think and reason, hence improve us as scientists and artists.

I would like to leave one other thought with you as an opener for this conference. Don't be hesitant to step out of the field of range management in pursuing your chosen profession. Remember you are working first with people, secondly with range, and thirdly with animals (both domestic and wild). You will find that very often the social, psychological and economic aspects of accomplishing a desired range management goal may be your greatest problem. Likewise, livestock production, nutrition and management cannot be ignored in range management. The range manager must be a "jack of all trades" -- and he must be a master of at least many of them.

Failure to keep up on the current literature, failure to exchange information and ideas with others in our and related fields and failure to think, explore and reason can head us down the road of being a "jack of all trades and master of none".

This conference is a valuable means of increasing our productivity and effectiveness.

STATISTICS OF THE RANGE SEEDING PROGRAM ON BLM LANDS

Howard R. DeLano
Bureau of Land Management
Portland, Oregon

Year	Oregon	Idaho	Nevada	California
Prior to 1959	81,238	292,785	324,939	38,693
5 years - 1959-1963	120,466	284,303	164,359	43,574
Total to 6/30/63	201,704	577,088	489,298	82,267
Estimate 1964 F.Y.	119,300			
Estimate 1965 F.Y.	113,300			
	434,304 acres			

Total of four states to 6/30/63 - 1,350,357

The above statistics emphasize the importance of crested wheatgrass seedings in the range management activities of the four states. The amount of forage produced on these seedings is tremendous. Seeding areas now existing and those planned will have a significant and beneficial impact on the livestock industry, the wildlife and watershed management programs.

REPORT OF RESEARCH RESULTS AT BENMORE, UTAH

Neil C. Frischknecht
Intermountain Forest & Range Experiment Station
Provo, Utah

(Studies in cooperation with Utah State University)

Eleven years' grazing study:

All combinations of three intensities and four systems of grazing cattle on crested wheatgrass spring range were compared for 11 years (1948-1958) at Benmore, Utah. Results were measured in terms of vegetation response and cattle gains.

Vegetation response:

Number of grass plants:

After 8 years of grazing, there were fewer grass plants in pastures that had been grazed at 80 percent intensity than in pastures grazed at 65 and 53 percent intensities. Also, more grass plants were found in pastures grazed under the rotational and removed-10-days-early systems than the 10-day-deferred and continuous systems.

Drought in 1956 caused breaking up of some plant crowns so that counts in 1958 showed plants with over 1-inch crown diameters had increased 33.1 percent between 1956 and 1958. Differences between treatments that were important in 1956 were not statistically important in 1958. In 1958, differences in the numbers of plants under 1-inch crown diameter help account for the important differences that had developed in numbers of large plants by 1956. Small plants were most abundant under the rotation and removed-10-days-early systems and under the lightest grazing intensity.

Grass basal area:

In 1956, live grass basal area was greater under both 53 and 65 percent intensities than under 80 percent intensity. Also, the rotational grazing system had developed the greatest live basal area and the removed-10-days-early system had developed the lowest. Live basal area for the 10-day-deferred system was second high to the

rotation system. Unlike the differences in numbers of plants, the 1956 differences in live basal area persisted both in 1958 and 1959 (after grazing had terminated).

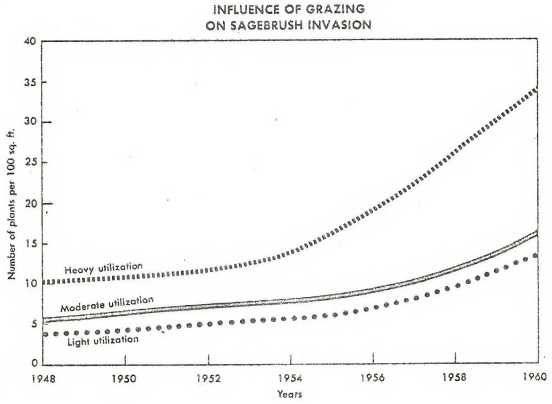
Grass yields:

Data in 1959 when pastures were not grazed in the spring, revealed that heavy grazing had reduced grass yields compared to the two lighter intensities. Yield differences between the four systems of grazing were not statistically significant (P .05). A positive correlation of 0.94 existed between average grass yields and winter-spring precipitation (November through May) for the last 6 years of the study.

Brush invasion:

Up to 1956, the heaviest intensity of grazing had allowed greatest invasion of big sagebrush and rubber rabbitbrush. Accelerated increases of both species in 1957 for all treatments are attributed to greatly increased spring precipitation. After 1958, there was some decline in frequency of occurrence and in number of plants of both species, but the decline was minor for big sagebrush compared to rubber rabbitbrush.

Pastures showing greatest decrease in grass yields were those showing greatest increase of big sagebrush. In contrast, rubber rabbitbrush did not adversely affect grass yields. The presence of rabbitbrush appeared to improve crested wheatgrass for fall grazing.

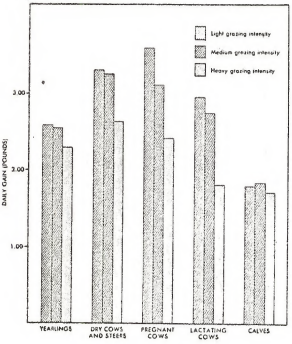


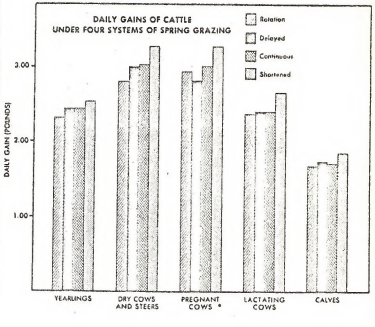
Cattle response:

Daily gains:

Daily cattle gains were influenced by intensities of grazing, systems of grazing, cattle classes, and years. An increase in utilization from 65 to 80 percent significantly reduced daily gains for all classes of animals. However, an increase from 53 to 65 percent utilization caused significant reduction in daily gains of lactating and pregnant cows only. Dry stock, yearlings, and calves gained almost as well under 65 percent utilization as they did under 53 percent utilization. Since pregnant cows calved in the pastures, the lactating cows were the most sensitive indicators of heavy use in this study. Removal of cattle from the pastures 10 days early produced the highest average daily gains of the four systems of grazing. Daily gains tended to be lowest under the rotational system.

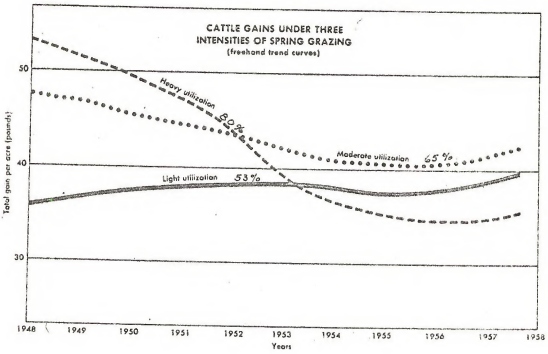
DAILY GAINS UNDER THREE INTENSITIES OF SPRING GRAZING





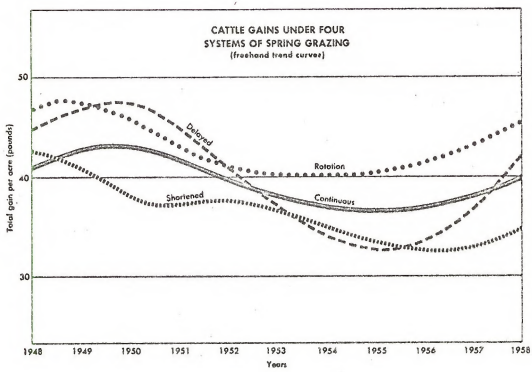
Gains per acre:

Gains per acre averaged 42.8, 39.9, and 37.1 pounds for the 65, 80, and 53 percent utilization, respectively. The heaviest grazing intensity produced the greatest gain per acre in the first, second, and fifth years, and the least gain of the three intensities during the last 5 years of study.



Stocking level:

The highest average stocking level over the years resulted from the 80 percent intensity, but trends showed that numbers were being reduced greatly when compared to the 53 or 65 percent intensities. For the four systems of grazing, the stocking level averaged highest for rotational grazing; the lowest level resulted from removing cattle from pastures 10 days early. The continuous and 10-day deferred systems averaged nearly equal in stocking levels between these extremes.



Fall grazing:

During three years of fall grazing, lactating cows nearly maintained their summer weight, while young dry stock and calves gained weight. Pastures utilized to 53 percent in the spring were stocked to about half the spring levels in the fall. Fall stocking rates on pastures that had been utilized at 65 percent in the spring were one-third lighter than spring levels. Pastures utilized at 80 percent in the spring could not be depended upon for fall grazing, which resulted in over-all discontinuance of fall grazing in this particular study.

Current studies:

Fall grazing by sheep to control brush:

A study was inaugurated in 1962 to determine if fall sheep grazing would control sagebrush on crested wheatgrass range used also for cattle grazing in the spring. Two years' results show that there is good possibility of brush control by sheep grazing in late fall where brush invasion has been moderate, but the chances for control are slim

where brush invasion has been heavy without excessive loss in sheep weight. Sheep lost less weight in 1963 when there was some fall regrowth of grass than they lost in 1962, when there was no fall regrowth and grass was dry. In 1962, sheep ate mainly the seed heads on the dry grass. In 1963, sheep preferred the green regrowth, but they also ate much of the growth left from spring. In both years, the utilization of big sagebrush averaged about 30 percent where invasion had been moderate, but only 5 to 10 percent where invasion had been heavy. In contrast, utilization of crested wheatgrass averaged about 45 percent where brush invasion was moderate compared to about 65 percent where brush invasion was heavy.

Cattle grazing - spring, summer and fall on crested wheatgrass:

Since 1961, cattle have been grazed on some ranges at Benmore from April to December. Some preliminary findings are:

1. Cows, yearlings, and calves made good gains during spring grazing of seeded ranges.

2. Gains made by yearlings and calves were reasonably good throughout the summer and early fall; fall and summer gains for cows were low.

3. Supplemental feeding with soybean meal (3/4 pounds per head per day) increased the gain of cows and calves only slightly during the summer but did not increase the gain of yearlings. In the fall the feeding of the supplement increased the gain of all three classes of cattle.

DAILY GAINS OF CATTLE ON SUPPLEMENTED CRESTED WHEATGRASS RANGE:

	Yearlings		Cows		Calves	
Grazing period	No supplement	Supplement	No supplement	Supplement	No supplement	Supplement
Early spring	2.72		2.28		1.70	
Late spring	1.87		1.62		1.63	
Summer	1.00	0.96	0.20	0.27	1.52	1.71
Fall	0.22	0.67	-0.36	0.39	1.57	1.69

Cooperation--Its Place in Range Management[1/]

by

Charles E. Poulton

Range Management is a big job! Its very nature draws large groups together and demands imaginative but sound thinking and effective planning to get the job done. The inherent complexity of the range resource and the diversity of its users make the cooperative way mandatory. The tremendous Bureau activity in range improvement through seeding, spraying, water development, fencing, etc., has increased the need for a cooperative approach with range users, the responsible wildlife agencies and range interest groups. We have some unique problems as professional and practical range managers that make full cooperation difficult. Let us look at some of those which, to me, are most important so that we may live with, solve or circumvent them in attaining effective range management cooperation.

The most critical problem in range stems from compartmentalization of responsible agencies in State and Federal government. This creates one of our most difficult jobs--coordination of activity and decision making in management. Perhaps in no other country in the world are so many agencies and groups directly concerned with and/or responsible for different pieces of the same resource. In our country, this includes the private land owner and practically all the government agencies responsible for land, but primarily the Bureau of Land Management, the U. S. Forest Service, the Bureau of Indian Affairs, the National Park Service, the Department of Defense and State Land Boards and Commissions. In the Federal government and practically all of the respective states, these agencies hold in trust for future generations the public lands of our nation; and their holdings amount to substantial acreages within our framework of land ownership. The American livestock industry is strongly dependent on the use of lands controlled and managed by one or more of these agencies as well as their own private holdings. In addition, the big game resource of our country, controlled by the state governments, recognizes no administrative agency or private ownership boundary as they move across the landscape in quest of food and cover. We cannot, for one moment, afford to lose sight of the fact that administrative and management decisions made by any one of these agencies affects problems and decision making on land controlled by another. Without cooperation and coordination, especially the latter, in this decision making process, the range management job is only complicated, made more difficult, and progress denied or frustrated. In this setting, there is no room for isolationism and for individual empire building. The urgency of problems gives us no time to argue about whose job is most important. Again, without all pitching in to the fullest of our abilities and energies, progress is denied.

1/ A restatement from notes of extemporaneous comments by the author at the seminar banquet.

A second range management problem arises when and if we lose our perspective. Cooperative discussion and action are two of the best ways to retain the proper perspective. The problem is intensified by interest groups who have an honest and most generally a real economic and personal interest in the range resources and in your decisions and mine, in your activities and mine. These include the stockmen, water users, sportsmen and fish and game professional people, and recreationalists--not to mention John Doe citizen who is indirectly affected by range management decisions. You, as land manager, therefore, have the obligation to future generations to coordinate in fair and just balance the interests of these people for the long time good of the resources and dependent industries. I occasionally see evidence of decisions being made or activities being labeled in a way which will appeal to one group or another. It bothers me that, from where I sit, some of this appeal and job labeling is apparently directed not at what the job is or its importance but is intentionally directed to appeal to the largest pressure group with hope of either gaining their support and appreciation, of appeasement, or of gaining--if you will--the political advantage of the support of the group. If we are to succeed, this support must be each group with the others for the good of the resources upon which they all depend and for the Nation of which we are all a part. I am worried by what I see in a perspective that sometimes tends to do, sell or promote range management on a basis other than the industries primarily dependent on this resource. We need, for example, to remember that agriculture is the second ranking industry in Oregon and that the range livestock industry accounts for nearly $100,000,000 or just under one-third of the annual agricultural income of the State. Yet, this industry encompasses only a minor segment of our population. Do we occasionally lose the perspective of its importance in favor of other numerically larger groups whose interest and involvement in range management is much less direct? Effective cooperation forces us to keep a balanced perspective. The cooperative attitude causes each group to abstain from unreasonable demands or "management" requirements but also to resist, in an atmosphere of arbitration, such demands when and if they are registered.

The complexity and diversity of range management gives rise to the third major problem--the need for an ever-developing fund of knowledge. This problem can be examined from two viewpoints, the individual and the group. First, from the individual viewpoint: It is difficult, if not impossible, for one person always to learn or to know readily all the information he needs to handle some of the problems which confront him. As Art Sawyer suggested in his comments, "...you must somehow find time to keep abreast of new developments." You as managers must keep your minds open and ready to accept or test and apply the new information that will come from vigorously led programs of research. And, finally, you have a direct responsibility in the flowback of information to the research scientist so that you help keep him on the right track, keep him addressed to your problems, and most of all, you generate the demand for research dollars which in this sputnik age seems to have subjugated range management and many other kinds of biological research to the more spectacular aspects of the atomic age. Thus, you see both the close cooperative tie between management and research and your individual obligations in making this level of cooperation effective.

Now, from the group viewpoint: I put range research in this category because modern research demands more and more group participation--cooperation. Research in range management has an obligation to lead out in the discovery of new facts and in the development of improved range management techniques and practices. Most of all, researchers have an obligation to make these new developments readily and quickly available to those of you who may use them. Your seminar is an example of this function and you are to be commended for giving the experts in crested wheatgrass management an opportunity to do this part of their job; but I would emphasize the direct responsibility each of you holds in making this and other new research effective. Management also has some group responsibilities in the light of developing knowledge. It is important that you as agencies keep your operating rules, regulations and procedures tight and static enough to provide continuity and efficient administration. Do not, however, lose sight of the need to keep them flexible enough to accommodate the development of new knowledge--some of which will force the discard of old "truths." Such flexibility makes the cooperative approach easier. As a group, we should remain aware that sound thinking, planning, decision making and action are oftentimes best done when they are influenced by an interested group of people with varied but relevant backgrounds.

The risk of imbalance could be defined as the fourth major problem which requires cooperation for solution. Effective range management must consist of keeping private improvement, development and management commensurate with Federal and State range management activities. It is possible, through programs such as the Vale Project, to get temporarily out of balance in the production of government range feed in relation to that of the commensurate base properties. In addition, every act of improvement through cultural means, every act of range development through water, fencing and trail construction, demands action on the part of the range user--action by the livestock operator and action by those who control the populations of big game animals--to keep animal management and control activity in line with the demands and effective use of the more productive range. This problem brings Extension and the Soil Conservation Service directly into the picture as your cooperators. It gives them both an essential and key role in helping to educate, stimulate and guide the range management activities on private ranges and in helping to stimulate effective animal management on government ranges.

Finally, a lesser but important problem is found in the image of range management which we have created. In some respects, conscious efforts to modify it are in order. Range management consists of far more than just the agronomic increase of feed production, of water, fencing and other developments or of cutting animal numbers. Range management is integrated resource management in which the key feature is the way in which animals--domestic and wild--use the resource upon which they are dependent. Until animal use is good, production maximized, and ranges are in good or improving condition, our cooperative job is not done.

Since range management is so intimately tied to cooperation, and I hope I have convinced you of this if convincing was necessary, let us look at some of the essential components of effective cooperation. I suggest that you think about them and make them a part of your own mode of operation.

1. Cooperation starts with an honest desire to work together and a realization that together we tend to do the best job.

2. Cooperation tends to start from a position of the "closed mind" and move thru the stages of the "open mind," or willingness to listen, to the productive stages of mutual "confidence" and "belief."

3. Cooperation can begin only with an open mind which follows effective communication and understanding. These are prerequisite to cooperation. We cannot communicate and understand one another unless we get together on mutual problems.

4. We must realize and accept the simple fact that cooperation takes more time than unilateral action. We are characteristically impatient beings. It is admittedly much easier to make an independent and individual decision and go ahead with the job; but, most important, the seemingly slower, cooperative approach oftentimes counts for more progress over a ten-year period than can possibly be generated by completely independent, non-cooperative action.

5. One of the most essential ingredients in cooperation is a willingness to recognize the contribution of others. Give credit where credit is due; recognize your buddy who gives you a good idea or helps you through a difficult problem-situation. Open your own mind to the views of the other fellow, ask for his help and you will find him listening to, not resisting, your ideas. This applies both in relations with range users and among us as professional range people. Don't worry about who will get the credit. If the job is well done, the cup of credit will overflow for every participant.

6. From realization of these points, pitch in without reservation for the good of the resource and the dependent industries. Do the whole job of range management.

With the above approach, cooperation develops automatically without our conscious effort; and we move forward in an atmosphere of harmony. If we develop our own personal contributions to the job from a sound base in fact and truth and in an atmosphere of sincere willingness to listen and carefully consider the viewpoints, problems and attitudes of the other fellow, we find that cooperation is contagious. Sound job accomplishment becomes inevitable and rapid. Let us all make our contributions to range management and to the range profession by engendering success through cooperation.

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GRAZING CRESTED WHEATGRASS IN NEVADA

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Crested wheatgrass can be grazed profitably in spring, fall or winter. From heading to dough state it is least palatable. Yearlings graze it from April to June, gaining two or more pounds daily. Wet cows and ewes do well on it during that period, and also after seed maturity to weathered stage. Dry cows and steers are wintered in good condition by several ranchers. Substantial savings in hay, 38T and 31T, have been made by grazing a new 100-acre seeding of crested wheatgrass. About 80 cows grazed during open weather in December and January at 6200 ft. elevation in Elko County the last two years. Optimum season of use depends upon the need of the user.

Crested wheatgrass endures intensive utilization extremely well. Acre plots at three dissimilar sites have been grazed to average stubbles of 1" to 1-1/2" annually since 1955. Mortality has been measurable at one location. Crested wheatgrass in random units on the same study area was grazed on the same dates to average stubble of 2-1/2" to 3". Trends in cover and survival at the two intensities were similar. It is concluded that crested wheatgrass is not sensitive to moderately different intensities of utilization.

Differences in season of use are reflected in cover changes by crested wheatgrass. Either heavy or moderate grazing when the leaves are about 6" long (early) is more damaging than grazing 6-8 weeks later. Sagebrush is held in check better by delayed than by early grazing.

On some areas the trampling associated with close grazing induces invasion by such annuals as halogeton, Lepidum perfoliatum and Bromus tectorum.

Optimum management depends upon density of the original stand and the quality of the site. An excessive stand on a marginal site cannot be improved by deferment or alternate year rest. Partial stands, on the other hand, can be induced to cycle by grazing occasionally in fall or winter rather than always in the spring.

Destructive grazing of crested wheatgrass over a period of 10-20 years may be warranted if site deterioration is not occurring. Two old, depleted stands of crested wheatgrass were disked thoroughly and seeded immediately in the same way as adjacent checks always in native brush.

Similar stands were obtained. The differences in yield the second year were not significant. The third year the significant average difference in yield was 300 pounds in favor of the new sagebrush land. Harvest was before seed cast.

Fertilization with N, P, and S has not proved economical although highly significant increases are obtainable from 30 to 90 lb. of available N per acre. In one trial N-60 produced an increase in yield for 2 years but the check plots yielded more the third and fourth years so that the 4-year average difference was not significant.

The encroachment of sagebrush into crested wheatgrass strongly reflects the grazing management on some sites while on others, factors other than grazing are more in control. On marginal sites for wheatgrass the brush problem can be met at the cost of light use, deferred grazing and herbicide application. On a better site under heavy use as 3-1/2-acre land, and moderate use 4-1/2 A/AUM, sagebrush and rabbitbrush have decreased in density. Density = No. plants/unit area. From 1951 to 1961, the net increase in brush cover, both species, was greater under heavy use. Used at 4-1/2 A/AUM, rabbitbrush cover made no change while sagebrush cover increased 34 percent. Both crested wheatgrass competition and utilization by Aroga websteri are credited with holding sagebrush to a cover percent of 1.25 on the plots, after 16 years of grazing. This was up from 0.61 in 1951, used at 3-1/2 A/AUM.

MANAGEMENT OF CRESTED WHEATGRASS IN IDAHO

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Crested wheatgrass has made possible the improvement of grazing capacities on over a million acres of rangeland in Idaho. It has been estimated that an additional 2½ to 3 million acres of public domain could be improved by range seeding in the state.

The greatest seeding activity has occurred in the years after 1950. The halogeton scare caused Congress to appropriate money for halogeton control and a reseeding program was initiated in the fall of 1951 by the Bureau of Land Management for this purpose. This program continued for a number of years and the benefits are only now being fully recognized. A continuing program of range improvement is being carried on by the Bureau of Land Management and other state and Federal agencies. Ranchers are becoming more aware of the benefits to be gained from the seeding of presently low producing range land and are seeding an ever increasing amount of this type of land to adapted species, particularly crested wheatgrass. (Agropyron desertorum and A. cristatum).

Substantial increases in livestock carrying capacities have been achieved through the range reseeding program that has developed. A 2,000 acre seeding at Almo, Idaho, had a production of less than 10 pounds (8.1) per acre of herbaceous material in 1951 prior to seeding but has averaged over 500 pounds per acre in the twelve years after seeding. Two other areas sampled prior to seeding showed a production of 78 and 38 pounds per acre before seeding and in the neighborhood of 400-500 pounds of forage in the 14 years since seeding. The Point Springs area had a licensed use of 27 acres/AUM prior to seeding and between 3 and 4 acres per AUM after seeding.

As can be seen from the previous statements, range improvement, through artificial seeding, has advanced tremendously since the early work of Sampson in 1907. Improved and new machinery, improved methods of seeding, increased knowledge and understanding of plant requirements, species adaptability, etc. have all contributed to this advance.

Standards for the management of crested wheatgrass seeded range land are less well established than the procedures and techniques of successfully planting these species. Significant contributions, however, are being made in this area by the work presently underway and to be discussed at this conference.

The old stand-by principle of management stating that you should "take half and leave half" has generally been applied to established stands

of crested wheatgrass. Information was not available to recommend otherwise and thus a rate of 3-4 acres per AUM in areas where the production averages between 500-600 pounds per acre has generally been applied.

The question that is in need of answering is whether or not this level of use is a sound one for obtaining maximum sustained livestock production from range lands seeded with these species.

The University of Idaho initiated a project in 1953 to evaluate the benefits of range improvement through artificial reseeding in the state. Several departments including Agronomy, Animal Husbandry, Agricultural Economics and Range Management were involved. Eight large seedings were selected for study in the southern part of the state. Sites were established on each of these seedings to determine stand density of the seeded species and the resident annual and perennial plants, and to follow the changes that took place in those densities over a period of years. It was planned to determine forage production and utilization of each seeding and the animal response obtained under the type of management practiced. For a number of reasons this wasn't possible and so the cooperative grazing study on the Point Springs seeding was developed for this purpose with the Bureau of Land Management, several livestock producers at Malta and the University of Idaho participating.

Since the general pattern of grazing crested wheatgrass seedings in southern Idaho was from the 1st of May to the middle of June in the spring and for a like period in the fall, it seemed advisable to evaluate the effect of intensity of grazing during those two seasons of use. The intensities selected were those used at Benmore (50%, 65%, 80%). Six 160 acre pastures were fenced in the fall of 1954 and grazing trials began in the spring of 1955 and have been continued to the present. Three pastures were used in the spring and three in the fall, one at each intensity, until 1960. After the grazing trials in the fall of 1959, the 160 acre pastures were cross fenced to make twelve 80 acre pastures one-half of which grazed both spring and fall. The results of the combined seasonal use will not be reported at this time due to the short time that they have been under investigation.

The vegetation was sampled at the beginning and at the close of each grazing trial. Counts and frequency tabulations were made for each species in a number of 2.4 square foot plots.

Yearling animals to be used were individually weighed at the beginning, at the end of 28 days and at the conclusion of the 45 day trial period. Each animal was tagged and graded at the time of the initial weighing.

Production on the pastures has varied widely during the 9 years of study, being as much as five times greater in the best than in the poorest year. The greatest variation has occurred in the moderate and heavy-use pastures in both seasons of use. This is partly due to grazing pressure and partly to differences in stand density at the beginning

of the study. The light-use pastures had a greater stand density at the beginning than either the moderate or heavy use pastures. Carry-over of forage from one year to the next also reduced yearly variability and this carry-over was greatest in the light-use pastures.

Desired utilization levels have been difficult to obtain. Highly variable production, lack of flexibility in animal numbers, variations in animal behavior and a lack of clairvoyance to predict growing conditions during the spring of the year are some of the reasons for this difficulty. Deviations from the desired rates have been mainly in the direction of less utilization than was planned. Grazing in the spring starts about the time that active plant growth is getting underway. As a result, utilization falls short of that desired, if growing conditions are favorable and use may be greater than desired if conditions are unfavorable.

Stand density of the crested wheatgrass has shown a general improvement in all pastures during the 9 years of study. When the study started, the crested wheatgrass stand was thinner and less uniform in some parts of the pasture area than in others. Reasonably good growing conditions in 1955 and 1956 produced some improvement. Favorable growing conditions in 1957 caused a marked improvement in stand density and distribution of crested wheatgrass. Unfavorable climatic conditions in 1960 and 1961 caused a reduction in stand density in all pastures so that an all time low, except for the initial year, was reached in 1962. Improved growing conditions in 1962 and 1963 produced an increase in stand density at the time of sampling in 1963.

Improved distribution of crested wheatgrass in the pastures contributed to the general increase in plants per unit area during the study period. The cover of sparsely vegetated spots thickened and bare spaces were invaded by the seeded species. Frequency of crested wheatgrass plants in all pastures increased from less than 70 percent in 1955 to more than 90 percent in 1959. The extremely dry years of 1960 and 1961 caused a decrease in the uniformity of distribution as shown in the 1963 counts but frequency was still in excess of 80 percent. The effect of grazing intensity on frequency of occurrence has not been large through 1963, although the light-use pastures show a more uniform distribution of crested wheatgrass in 1963 than the pastures used at heavier rates.

Stocking rates for each pasture were judged according to the production or anticipated production in each year. Yearling animals were desired for the trials but it was not possible to obtain this age class at all times. The animals used in the spring ranged in weight from 378 to 520 pounds and averaged between 430 and 447 pounds over the 9 year period. The average weight of animals grazed in the fall was 160 to 174 pounds heavier than those used in the spring.

Gains in the spring of the year averaged between 99 and 106 pounds per animal for the nine years. During the 1963 season, the pastures were grazed for an additional 39 days and the gain per animal ranged between 147 and 169 pounds for this longer period. Fall gains have been less

as would be expected on dry feed, and have averaged between 28 and 30 pounds per animal. Average gain per day has been in excess of two pounds in the spring and approximately two-thirds of a pound in the fall. Gain per animal and average daily gain has been greatest in the light-use pastures and least in the heavy-use pastures in both seasons. Gains per animal and gain per day increased in the fall when the season was moved to an earlier date. Green growth during the fall period in 1959 and 1961 produced gains in excess of one pound per day.

Average gain per acre ranged between 40 and 51 pounds in the spring and between 13 and 16 pounds in the fall. Greatest gain per acre was obtained on the heavy-use pasture both spring and fall.

Climatic conditions during the spring of the year appear to have been the dominant factor in producing variations in stand density of the seeded species, and in the amount of annual plants and their distribution in the pastures. There has not been any material change in the density of woody species found in any of the pastures during the nine years of study. Big sagebrush and rabbitbrush, however, have increased in size over this period.

After nine years of grazing, the heavy-use pastures are still producing satisfactory livestock gains. From the standpoint of gain per acre, this intensity of use has been the most productive. The desired level of use, however, has been obtained only in the last six years in the spring grazed pasture and in five of the last six in the fall grazed one. Furthermore, certain changes are taking place in the heavy spring-use pasture that indicate possible lower livestock production in the future. There are a greater number of dead crested wheatgrass plants here than in the light or moderately used pastures and plants with less that full crowns show a greater frequency. Annual plants, especially halogeton, are more abundant, and are distributed more widely over the pasture area. Forage production per acre is proportionately less at the end of nine years than in the other pastures.

Heavy fall use as yet does not appear to be detrimental to the seeded stand and production was maintained through the ninth year of the study.

Light use of crested wheatgrass, spring or fall, does not appear to be desirable for maximum sustained livestock production. Although individual animal gains are slightly greater than under the other intensities of use, they are not sufficiently better to offset the greater gain per acre achieved at the moderate and heavy intensities. Under light use, grazing is patchy with the grazed patches receiving fairly heavy use while parts of the pasture remain ungrazed. The yearly accumulation of dry material in the ungrazed plants causes them to be even less desirable to the animals in subsequent years and thus they do not contribute their share to livestock production.

MANAGEMENT OF CRESTED WHEATGRASS STANDS ON THE CROOKED RIVER NATIONAL GRASSLAND

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It is a pleasure to be here to share with you the rewards of good grassland management and to explore with you some of the devices which we have used to achieve our results. Grassland management is the one area where a man in a brief portion of his career can harvest such rewards as increased forage production, increased stand vigor, and increased appreciation by the permittees before he moves on. Conversely, it is one of the few areas of management where one can reap the results of his own mis-management if he is so unfortunate as to linger long enough.

Most of the preceding speakers have explored some phase of crested wheatgrass management through certain aspects of research. My task is to share with you management of crested wheatgrass stands on the Crooked River National Grassland. Ken Parker says that the most practical means of improving and maintaining native and seeded ranges is through proper management.

We will cover the basic fundamentals - the ABC's of crested wheatgrass management, first. Refinements in management of this species will follow with problems dealing with associated species, differences in seasonal palatability, maintenance of bitterbrush, consideration of different herd makeup, and effects of range improvements on distribution.

Area and History - The Crooked River National Grassland is a 105,945 acre area located in Jefferson County, Oregon adjacent to the towns of Madras, Metolius and Culver. In the mid-1930's the Resettlement Administration purchased around 92,000 acres of marginal and largely abandoned cropland under the Bankhead-Jones Farm Tenant Act, reserved about 13,000 acres from the Public Domain and acquired the rest by land exchanges.

First seedings were drilled in 1936, many of which remain as excellent stands of crested wheatgrass today. Initial work consisted largely of seeding, razing of old homesteads and homesteader fences, construction of water developments and new fences.

In 1947, administration was transferred from the Bureau of Agricultural Economics to the Soil Conservation Service. On December 20, 1953, the

administration of the Land Utilization project, reclassified and renamed Crooked River National Grassland in 1960, was transferred to the United States Forest Service, Ochoco National Forest, Prineville, Oregon.

This development story is one of unusual cooperation between members of the Gray Butte Grazing Association and the Government. Cooperation with the user, or permittee and free flow of information about anticipated changes, good or bad, is essential. We gratefully acknowledge the key role played in the management on our lands by the Gray Butte Grazing Association.

The Gray Butte Grazing Association was organized by approximately 140 members in 1949. The five-man board of directors conducts the Association's business in monthly meetings. In addition, Clair Osborn is manager for the association. Clair rides herd on the permits, the pastures, the cattle, and maintains water developments and fences.

Problems and Solutions

The grassland is primarily spring-fall range with an increasing amount of summer use. Separate pastures are provided for steers, cows and calves, and heifers, with pasture rotations of three to five pastures each. Moves are planned to minimize stock disturbance and yet fit the physiology of the bunchgrasses involved. The rotation-deferred system of grazing was planned in 1949 and implemented in 1950.

We have a seven-month grazing season stretching from May 1 to November 30. This grazing season is split into three periods with three separate turnout dates and count-ins: Spring, May 1 - July 25; Summer, July 26 - Sept. 30; and Fall, October 1 - November 30. For management purposes, the spring, or growing season, is further split between early spring and late spring. Early spring, from May 1 through June 1; and late spring, from June 1 through July 25.

Weighted utilization checks on where and how much each pasture is grazed, provides an accurate method of determining how well the system is working, where we need improvement and where our distribution problems lie.

In arriving at carrying capacity, we must emphasize that on the Crooked River National Grassland we do not have fixed carrying capacities for any given pasture. Carrying capacity varies from season to season and from year to year. For example: A pasture with a total production in this year of 1000 aum's would be utilized for 300 aum's in early spring, 450 aum's in late spring and 650 aum's in summer or fall. These tentative carrying capacities are further corrected by our last utilization

check, by the type of use received in the previous year; by our rating as to the vigor of that pasture and by management objectives. The preceding winter's precipitation also serves as a useful guide in determining the current season's forage production.

A successful grazing system must be flexible. Without flexibility, the first unforeseen development or emergency would torpedo an entire grazing system. A pasture with low plant vigor might be used in late summer or fall for several years.

Keynoting all our efforts is the attempt to work with nature to the best of our limited understanding of her. For example: water is developed, not just because water is there (limited as it is in an 8.8 inch average precipitation belt), but rather, because that new water will make available additional forage.

New fence location is studied first by topography, range types and available water, and finally by the actual movement of livestock grazing in the area. Poor fence location can render large areas of rangeland unavailable to the very animal use patterns these fences should be designed to improve.

Known seasonal palatibility of different species of grasses and shrubs are used in split season grazing to serve almost as well as a division fence to extend the safe grazing capacity of a pasture. An example of this practice is a pasture which consists of flat reseeded crested wheatgrass stands and rolling hills covered with bitterbrush and native bluebunch wheatgrass. The cattle will graze the reseeded stands in early spring, be removed, and return in the fall season to concentrate on the native range on the rolling hills.

One of our major problems and seemingly an exception to the policy of working with nature is the increase of rabbitbrush on the abandoned cropland and in the reseeded stands. Plowing up the original bluebunch wheatgrass-sagebrush areas disturbed nature's balance. Rabbitbrush increased and multiplied. Abandoned cropland today produces only rabbitbrush and a limited amount of cheatgrass, which in good moisture years averags 15 to 50 acres per cow month. Reseeded stands will produce up to one cow month per acre, and average about 2-1/2 cow months per acre. Rabbitbrush will also encroach on reseeded stands, robbing them of moisture and thereby cutting the production by two to five times.

We have worked out effective and consistent chemical control of rabbitbrush by applying basic research results to our area, by the use of ester 2,4-D, at the rate of 2 lbs. acid equivalent per acre in a diesel

carrier. Our standards call for a minimum of four inches of new twig growth on both green and rubber rabbitbrush and for soil moisture sufficient for maximum plant growth, at or within four inches of the soil surface. When soil moisture drops below this four-inch zone, green rabbitbrush growth is retarded and kills are reduced.

The only practical way to cover any appreciable amount of area during the most susceptible period is by aerial spraying. Control of this operation is maintained by flagmen and radios. We have switched from fixed-wing aircraft to helicopter. We feel the latter is a more flexible tool. Temperature and wind are limiting factors in aerial spraying.

In 1956, Bud Adams, Bill Currier, now with the USFS in Albuquerque, and I modified the rangeland drill into an effective deep-furrow unit. Rabbit and sagebrush stands are first sprayed and then drilled directly by the modified rangeland drill, eliminating the necessity and disturbance of plowing. Spraying and drilling reduce costs by up to $6 per acre over that incurred by plowing and drilling, and increase grazing capacity ten to twenty times over that of abandoned rabbitbrush invaded lands.

Several basic principles of grass seeding are involved in the operation of the deep-furrow modification of the rangeland drill. The bottom of the furrows furnish a firm seedbed which holds and collects winter moisture. On rough, loose seedbeds seed can be placed at a more constant depth and be more evenly covered than with a regular drill. The seed is not actually covered deeper, it is just in the bottom of a furrow. Proper timing of drilling effectively eliminates immediate competition by annuals with the new seedings. The drill cultivates about a four-inch furrow. On the interstices between the furrows the shallow-rooted annuals grow and quickly cure during summer drought. These dry annuals then shade and protect the new seedlings, which continue to grow. Another advantage of deep-furrow drilling without plowing, is the retention of the remaining grasses between the furrows. The furrow protects seedlings from winds and high temperatures. It also aids in prevention of frost heaving. Good farming practices such as cross-slope placement of furrows, tends to eliminate rill erosion. Elimination of plowing reduces soil loss and accompanying soil drift into furrows, which buries seed too deep.

Refinements in Management of Crested Wheatgrass -- Often it is necessary to manage new stands of grass in a predominantly older established stand. These new stands have a preferred palatibility to livestock. Management must recognize that these areas will be over-utilized first.

Within the framework of rotational-deferred system of grazing there are many ways in which a stand may be used. With a four pasture system, it is possible to use the same stand in early spring and a late fall, the so-called two step method of harvest.

It is desirable with a four or more pasture system to have units of varying carrying capacities within that unit. This gives a rotation not only according to the system, but within the system.

Often we are required to manage a mixed stand of grasses, within one unit. This can be a native bunchgrass stand on the hills, with re-seeded bottoms to crested wheatgrass, or sometimes, a mixture in a seeding. We have covered the management and the advantages of the difference in seasonal palatibility between bluebunch wheatgrass, for example, and crested wheatgrass.

Several of our pastures contain a mixture of crested wheatgrass and Whitmar beardless wheatgrass in the same stand. Normal rotation, if followed as outlined in a rotational-deferred grazing, will take care of these seasonal differences. When used in early spring, crested wheatgrass will be over-utilized; Whitmar beardless wheatgrass under-utilized. When used in late spring, summer or fall, the reverse would be true.

We are establishing many new stands of crested wheatgrass and alfalfa. The alfalfa is drilled in the same rows with the grass. The advantages of using alfalfa are that nitrogen is furnished to the grass plants and palatability is extended after crested wheatgrass becomes rank and unpalatable. When alfalfa is an important component of a stand, we have found it necessary to allow the alfalfa to head out and ripen seed at least every third year.

Do you have to manage crested wheatgrass with bitterbrush? In our area bitterbrush is first utilized heavily after mid-July. In alternate years the bitterbrush is allowed to mature and produce seed before it is grazed. On those years when the grass is grazed in early or late spring, the bitterbrush is utilized only lightly.

When to use or not to use nitrogen on the range is often asked. In March of 1957, we established ten plots on a November 1939 seeding of standard crested wheatgrass and bulbous bluegrass. The old stand was good, but low in productivity. We put out three replicas each of 20 pounds effective nitrogen and of 40 pounds effective nitrogen, in the form of ammonium sulfate, along with some check plots. This was a clean stand of crested wheatgrass.

At the end of the first growing season, both the 20 pound nitrogen plots and the 40 pound nitrogen plots could easily be defined by the stand of cheatgrass growing in the crested wheatgrass seeding. This was even more pronounced in 1958 and 1959, the second and third years. By 1959, the 20 pound rate produced 120 pounds of crested wheatgrass per acre and 140 pounds of cheatgrass. The forty pound rate produced only 110 pounds of crested wheatgrass and 165 pounds of cheatgrass, while the checkplot produced 210 pounds of crested wheatgrass, with only a trace of cheatgrass. This was nearly twice the production of crested wheatgrass on the checkplot compared with the 40 pound nitrogen plots. It was also about 60 pounds greater than that with the 20 pound rate. Our findings only confirmed those results reported by various researchers. We cannot recommend addition of nitrogen fertilizer to establish stands of grass in our 8-10 inch rainfall belt.

NITROGEN PLOT STUDY

Year	Treatment	Adge	Brte	Total	Acres per Cow Month of Safe Utilization
1957	Check	560	T	560	2.8
	20# N.	607	2	609	2.6
	40# N.	420	20	440	3.6
1958	Check	415	T	415	3.8
	20# N.	518	T	518	3.1
	40# N.	522	38	560	2.8
1959	Check	210	T	210	7.6
	20# N.	150	140	295	5.4
	40# N.	110	165	275	5.8

In 1962, the big 36-inch gas pipeline was completed. In our area, this entailed disturbance and serious loss of topsoil in over 270 acres. We used the deep-furrow rangeland drill and an equivalent of about 30 pounds effective nitrogen per acre, applied only in the drill rows. This produced an exceptionally fine stand of grass the first year, in which many of the new plants headed out and made seed. The nitrogen gave the new seedlings a head start over the annual competition.

Refinements in Management

Our cattle herds are separated into steer, heifer, and cow and calf herds. With steers or heifers, better distribution than with cow and

calf herds can be achieved. Moves can be planned without special consideration for the small calves and potential resultant loss. Steers are much more inclined to spook, with serious weight loss, so special handling is required.

In turning-in to fenced pastures it is desirable to utilize more than one entrance. Livestock tend to return to the entrance through which they were introduced. This is another economical way of achieving better distribution.

We practice dual use of pastures by both sheep and cattle. In those pastures which are planned for summer or fall cattle use, the bands of sheep are rapidly passed over these pastures in early spring. We turn the sheep out about two weeks prior to range readiness date for cattle and graze them for one month. The sheep utilize the early spring grasses and the forbs and achieve a weeding job for us. The next year a different set of pastures is used.

Our cumulative use chart data starts in 1950 when rotational-deferred grazing was first practiced on our area. We have color keys for each of our four seasons; early spring, late spring, summer, and fall. Actual use in aum's is typed in each year. The practical aspect of this chart is this: if emergency revegetation or other valid reasons force departure from the planned system of use, a desirable pattern of seasonal use may be maintained by use of this chart. This builds flexibility into the system.

Results

What have been the results of this intensive management and improvement program? Perennial grass replaced the dust circles around the waterholds. Increased vigor in both reseeded and native ranges resulted in an all-age class distribution. Increased vigor and seed production is noticeable in the desirable browse species such as bitterbrush. And finally, we gained the firm support of the system by our permittees.

Specifically, permitted use increased from under 1000 aum's in 1936, to 7200 aum's in 1955 and nearly 17,000 in 1963. This increase was accompanied by more even distribution of grazing.

What can be accomplished by judicious use of range improvements on specific areas? On the North Fox area, we constructed a new division fence of 3.1 miles, giving us two new units and two new water developments in 1962. In 1963, we piped a well over 3900 feet to this pasture. Actual use for the North Fox unit from 1957 to 1961 averaged 519 aum's. In 1962, with the improvements listed, we grazed 692 aum's on one-half the area. In 1963, using the total area we grazed 1275 aum's. Utilization was much more uniform in 1962 and 1963.

On the South Gray Butte area in 1962, we sub-divided a rough and varied topography into four new units with 7.1 miles of fence and developed six additional watering places. For the years 1957-61, we have an average use of 780 aum's. After development, we grazed 1153 cow months in 1962, using only two of the four units. In 1963, we used three of these units and grazed 1067 aum's. The South Gray Butte herd unit is under a six-pasture rest-rotation system.

I cannot recommend a rest-rotation system for management of established crested wheatgrass stands. Crested wheatgrass should be neither over-used or seriously under-used. If over-used it will lose plant vigor and subsequent year's production. If under-used, crested wheatgrass becomes wolfy and nearly unusable for cattle with drastic action.

Cost-Benefit Ratio

Here is my idea of a cost-benefit ratio curve for range improvements based upon admittedly insufficient data. We have used a 20-year amortization at 6% of a $3.50 per cow month figure, our current accepted commercial rate. We have two examples: one, the North Fox, which we have just discussed, and two, the North Grant Water Development. The North Grant cost around $3500, and increased safe grazing capacity 400 cow-months. The North Fox cost $6000, and produces 630 cow-months additional forage. A new manager could conceivably increase or decrease the slope of this curve. Most of us are financed only for the more rewarding first half of this cost-benefit curve. The main value in plotting such items is to re-emphasize the value of study of comparative cost-benefits in higher priority improvements.

Summary

In a brief fashion I wish to summarize. We have covered our system, our problems, and the benefits. We have discussed rotational-deferred grazing, weighed utilization checks, and flexible carrying capacities. We have emphasized the need for flexibility in grazing systems and the need to work with, not against, nature. We have illustrated what can be done by the judicious application of range improvements, such as water and fences, manipulation of seasonal palatibility, and actual-use records.

Chemical control of rabbitbrush can double production on good stands and increase production ten-fold when coupled with reseeding. We have explored some of the uses, flexibility and principles of deep-furrow drilling with the rangeland drill.

Finally, we have shared with you some of the refinements in the management of crested wheatgrass, with associated species, in mixed and pure stands, on the use of fertilizer, and of livestock manipulation.

We have summarized, by concrete examples, how carrying capacity on our area has progressed from under 1000 aum's in 1936, to nearly 17,000 aum's in 1963. Our projected carrying capacity eventually will double that of the present. And finally, we have constructed a cost-benefit ratio curve, to show what can be done to get the maximum return from the minimum investment.

RANGE SITES AND RANGE CONDITION

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Defined

A range site is an area of land having a distinctive combination of edaphic, climatic, topographic and natural biotic factors such that it is significantly different from every other such area. These environmental areas are considered as units for purposes of discussion, investigation and management. Changes from one site to another represent significant differences in potential forage production and/or differences in management requirements for proper land use.

A range site is an ecological entity. It can be defined, described and delineated. If properly defined and described, it will maintain acceptable uniformity of its distinguishing characteristics wherever it occurs.

All four types of factors - soil, topography, climate and vegetation - must be used for describing a site properly. Sites can be characterized, however, by using one or more of the four types of factors.

Example: 1. This site is a steep north exposure whereas that site is a south exposure.

2. This site produces an oak savannah whereas that site produces a normal grassland.

"Range", as used in this discussion, means all land producing native forage for animal consumption, and lands that are revegetated naturally or artifically to provide a permanent cover that is managed like native vegetation. This avoids haggling over definitions that confuse the issue by trying to distinguish between "native pasture", "range", "woodland" "forest", and so on.

Before we can formulate or apply a true concept of multiple use management, it is mandatory that the grazing aspects, along with all the other uses of the land, need to be studied and known.

Natural Biotic Factors

The plant community is the most important natural biotic factor of a site. It provides the differentiating characteristics of range sites. Essentially, the plant community is the marketable product of the ecosystem.

It is the crop to be managed. Grazing animals are merely a means of processing forage into useable commodities that lend themselves more readily to human consumption.

Native plant communities change with different uses and management. It is essential, therefore, that the vegetation of a site be determined and described.

a. as it is in climax or near-original condition so as to provide an index of the site's potentiality.

b. as it is in various degraded stages so as to provide an index for judging degree of deterioration or improvement.

Soil, topography and climate generally are more stable factors than the plant community. They must be taken into account, along with vegetation, when identifying sites, particularly in degraded conditions. They provide accessory characteristics for differentiating range sites.

Range sites are kinds of land that differ principally in the production of climax or near-original vegetation. The differences may be represented by a significantly different kind or different amount of vegetation, or both. A significant difference is one great enough to be important for evaluation of the grazing resource.

If two areas of rangeland in near-original condition have distinctly different plant communities, two range sites are involved even though their plant communities in degraded conditions are nearly identical.

If two areas of rangeland in near-original condition have similar plant communities but differ significantly in the amount produced or in the season during which the forage is available for grazing, two range sites are involved.

Other natural biotic factors which generally provide minor accessory characteristics for differentiating range sites include such items as:

a. Markedly reduced preference for certain types of land by livestock because of inherent features such as very steep slopes or extreme rockiness.

b. Distinctive preference for certain types of land by burrowing wildlife which normally results in concentrations, irrespective of population cycles, that significantly influence the use and management of the vegetation for livestock and grazing-game. Rabbits, gophers, ground squirrels and ants are examples of biota that prefer certain types of land for their habitat and compete with livestock and grazing-game for the forage crop.

c. Distinctive preference for certain types of land by grazing-game because of natural cover or lack of cover, availability of browse or other forage according to special seasonal needs, lack of snow cover in winter, and so on.

Climatic Factors

Macro-climatic factors which influence the kind and amount of vegetation and are used as accessory characteristics for differentiating range sites include:

a. Amount, character and seasonal distribution of precipitation.

b. Extremes, averages and seasonal distribution of air temperatures.

c. Distinctive wind, fog and storm patterns and seasons, particularly those affecting the growing season.

d. Elevation.

Micro-climate of a site generally is affected by local topographic features and by the character of the vegetational strata, particularly the overstory.

Topographic Factors

Local topographic features such as slope direction, gradient, and length commonly influence the kind and amount of vegetation and provide suitable accessory characteristics for differentiating range sites. Air temperatures are important micro-climatic factors generally affected by local topography. The amount and effectiveness of soil moisture also is affected by topography through such items as snow drifts and blow-off, run-off and run-on, reduced or increased evaporation due to exposure to or protection from sun and prevailing winds.

Soil Factors

The kind and amount of vegetation commonly is influenced by such soil factors as texture, depth, stoniness, infiltration rate, moisture supplying capacity, drainage, aeration, reaction and temperature. Soil factors provide very good accessory characteristics for differentiating range sites.

Inter-action of Factors

It is extremely important to understand that a very complex inter-action of factors exists in each ecosystem. A minor change in one factor can be accompanied by simultaneous significant changes in a number of related factors. It is practically impossible to segregate a single factor and evaluate its sole influence on the vegetation because of all the inter-actions that occur. It is practical, however, to recognize that changes in the net "effective environment" are accompanied by significant changes in the plant community and that these changes can be described and identified in terms of key indicator plants.

Range Sites versus Habitat Types

Vegetation-soil research commonly expresses the vegetational component of the ecosystem as a "habitat type". It is important, therefore, that the relationship of habitat type to range site is clearly understood. Otherwise, the research findings may be used improperly in range site guides and in range management.

The habitat type represents a particular plant association. It is characterized and named generally by using several of the dominant plant species, with dominance relating to the outward appearance of the vegetation. Scientific plant names are used.

Example: Pinus ponderosa - Purshia tridentata - Festuca idahoensis

Each range site represents a habitat type because both are based upon the plant association - the climax or near-original vegetation.

A habitat type, however, may represent one or more than one range site.

Example: Agropyron spicatum - Festuca idahoensis - poa secunda

This one habitat type occurs under three situations in north central Oregon:

a. On a north exposure having Walla Walla silt loam soil, below 1700' elevation and with 9 to 12" precipitation.

b. On an undulating plateau with Condon Silt loam soil, between 1700' and 3000' elevation and with 12 to 14" precipitation.

c. On a south exposure having Snipe stony loam soil, above 3500' elevation and with 15 to 18" precipitation.

These three situations constitute three distinctive range sites but only a single habitat type. The three sites are:

a. Droughty North Exposure - Columbia Basin

b. Rolling Hills - Columbia Basin

c. Moderate South Exposure - Blue Mountains

Range Site Names

Range sites are named to help ranchers and others to recognize and remember the important kinds of rangeland in their locality. Therefore, site names should reflect some important and relatively permanent physical features that can be recognized in the field easily.

Example: Steep North Exposure
Deep Sand Hills
Silty Terrace
Wet Mountain Meadow

Vegetation may change with treatment. Plant names, therefore, normally do not make good site names. In some instances, however, the use of a plant name, if done judiciously, increases the meaningfulness of the site name.

Example: Aspen Grove
Pine - Bunchgrass
Juniper Tableland

The plant used in the site name should be relatively persistent on the site irrespective of range condition.

Because of the limited number of permanent features suitable for site names, some duplication over a broad area like eastern Oregon is inevitable. Site names are not duplicated within a natural range area such as the Columbia Basin.

Range Site Symbols

Symbols for range sites are useful for mapping on relatively small scale maps on which site names would occupy too much space or clutter the map.

In Oregon, S.C.S. site symbols are numerical. They are connotative in accordance with a state-wide system for classifying range sites into natural groups. A range site classification system is very helpful to technicians, particularly where numerous sites are involved, because it

helps organize our knowledge so that properties of the sites may be remembered and their relationships may be understood more easily.

Due to the manner in which Oregon's S.C.S. site symbols directly connote the natural groups of sites and certain vital characterictics of each site, Oregon's site symbols are very useful for precise brevity in technical discussion.

RANGE CONDITION

Defined

Range condition, as used here, is the present state of the vegetation compared with that of the climax or near-original for the site.

The purpose in rating range condition is to provide an approximate measure of any deterioration that has taken place in the plant cover and, thereby, provide a basis for predicting the degree of improvement possible.

Range condition, has been called range health. Like health, range condition is relative. If a particular site is described as being in "Good" or "Poor" range condition class, the rating always relates the present plant cover to the kind and amount of native vegetation that particular site is capable of producing.

Range Condition Classes

Four range condition classes normally are used to express the degree to which the make-up of the present plant community has departed from the make-up of the original plant community. Departure from the original may be due to such factors as grazing, fire, prolonged drought, insects, rodents, ants, or disease, singly or in combination.

These condition classes are:

EXCELLENT — 75% or more of the make-up of the present plant community is still like the original for the range site. There is little or no current erosion. There is nearly a full stand of the major original forage plants for the site.

GOOD — 50% to 75% of the make-up of the present plant community is still like the original for the range site. Current erosion is no more than slightly active. The stand of major original forage plants is not less then 1/2 for the site.

FAIR — 25% to 50% of the make-up of the present plant community is still like the original for the range site. Current erosion is no more than moderately active. The stand of major original forage plants is not less then 1/4 for the site.

POOR — Less than 25% of the make-up of the present plant community is still like the original for the range site. Current erosion may be severely active. The stand of major original forage plants may be less than 1/4 for the site.

Meaning of Range Condition

Normally, the pattern of range condition classes within a ranch.

a. Reflects the long-time grazing pattern of the livestock and grazing-game.

b. Indicates the location and degree to which range improvements are needed.

c. Provides a basis for planning and improving grass management.

Terms Designating Plant Responses

When a range plant community begins to deteriorate, certain plants begin to reduce in the stand and continue to reduce - generally at an accelerating rate - as deterioration advances. Such plants are called DECREASERS by ranchers and technicians interested in determing range condition. Simultaneously, other plants of the original plant community increase in the stand and replace those being driven out. Such plants are called INCREASERS and, if these plants are palatable forage plants, they in turn will be driven out of the stand under advanced stages of deterioration. When the site is degenerated sufficiently and remnants of the original plant community can no longer command the site, outside plants - generally undesirable ones - encroach into the plant community. Such plants are called INVADERS.

These terms are used in range site descriptions and in guides to range condition class to describe the behavior of certain key plants under prolonged abuse or range recovery. Plants grouped in this manner provide the basis for developing guides to range condition class.

Procedure for Determining Range Condition Class

1. Identify the range site being rated.

2. Record the present plant community in terms of percent composition by species.

3. Determine what percent of the present plant community is climax for the site, using the Guide to Range Condition Class for that site.

4. Determine the final range condition class rating in accordance with the criteria stated for each condition class.

U. S. Department of Agriculture Soil Conservation Service

TECHNICIANS' GUIDE TO RANGE CONDITION CLASSES

DECREASERS: Plants that go out when range is abused. % figs. indicate approx. amt. found in climax for the site BUT COUNT ALL FOUND ON SITE TOWARD CLIMAX	INCREASERS: Plants that increase when range is abused. % figs. indicate approx. amt. found in climax for the site, SO COUNT NO MORE THAN AMT. SHOWN TOWARD CLIMAX.	INVADERS: Plants that invade when range is abused. These did not occur in climax so NONE OF THESE IS COUNTED TOWARD CLIMAX.
60% Idaho fescue T Giant wild rye	25% Bluebunch wheatgrass 10 Sandberg bluegrass 1 Prairie junegrass	Cheatgrass Soft brome
	5% max. in aggregate	
	2 Yarrow 1 Silky lupine 1 Phlox 1 Pussytoes T Milkvetch T Fleabane (daisy) T Buckwheat T Velvet lupine	Mustard Salsify Thistle
		Big Sagebrush Gray rabbitbrush Green rabbitbrush Matchweed

Columbia Basin Land Resource Area - Oregon
April 1961

MODERATE NORTH EXPOSURE
Site 53

RECOMMENDED REFERENCES

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IMBRICATED WHEATGRASS

Notes from Russian publication - INTRODUCTION TO THE CULTURE OF IMBRICATED WHEATGRASS - by I. F. Vladimirov

Agropyron imbricatum:

Leaves wider - heads more narrow at the top - seeds are larger than crested wheatgrass

Stalk does not yellow after ripening.

Four rather distinct forms of Imbricated wheatgrass - one spreading - one compact - two with compact heads, one awned and one awnless.

Can endure summer drought and winter cold.

Growth begins early - ripening occurs two weeks later than crested wheatgrass - more drought resistant.

Seed production in lbs/acre exceeds crested wheatgrass by 7 times - yields 3 tons of hay per acre. Greens up early.

(The grass appears to have many virtues)

CRESTED WHEATGRASS

Notes from Russian publication - CRESTED WHEATGRASS AND ITS CULTIVATION IN THE SOUTHEAST EUROPEAN RUSSIA - by P. N. Konstantinov

Bonanical forms:

Wide spiked - Agcr - Crested wheatgrass

Narrow spiked - Agsi - Siberian
Agde - Desert wheatgrass

Popularly called ZHITNYAK - ARZHANTSA except in Kirghis - there called IRKEK & BIDHEK

Many forms, as a result of cross pollinizing - Semi desert bunchgrass

Crested prefers chestnut or brown saline loams; also deep basalt saline loams.

Desert prefers sandy loam, sandy or light clay soils.

Progeny are not stable and segregate into a multitude of forms.

Characteristics of two basic forms

Broadspike (Fairway)	Narrowspike (Desert or Standard)
Less variation in spike form	
Spike broad - flattened	Spike narrow - elongated
Spike length - 5 cm	Spike length - 7.3 cm
Spike width - 1 cm	Spike width - .4 cm
Spikelets - linear-lanceolated	Spikelets - broad-lanceolated
Carination of glumes - not sharply expressed	Carination of glumes - sharply expressed
Awns better developed - 2.8 to 3/1 mm	Awns 1.8 to 2.0 mm
Color of spike at time of flowering - gray and bluish	Color of spike at time of flowering - green
Color of glumes at seed maturity - violet	Glume pigmentation absent at seed maturity
Color of spike at flowering - green	Color of spike at flowering - gray
Seed awned - 2 to 4 mm	More bunchy
Lighter seed - 1.42 grams/1000 seeds	Seed usually less than 1 mm Heavier seed - 1.66 grams/1000 seeds
More drought resistent and earlier maturing	Heavy seed - 1.66 grams/1000 seeds

Less liable to encroachment by other plants	
Time necessary for germination - 6.3 to 15.2 days	Time necessary for germination - 7.0 to 17.0 days
Susceptible to red-rust infestation	Rarely attacked by red-rust
Hay harvest (8 years) Average 2000 lbs/ac	Hay harvest (8 years) Average 2435 lbs/ac
Less affected by spring frosts	Greater seed producer
Yield equal or somewhat more than narrow spiked in dry years	Outyields broad spiked 1.5 to 2 in moist years
Higher transpiration coefficient	

Crested wheatgrass has a fairly high coefficient of digestibility.

Crested wheat cannot endure deep and rough planting - 1 to 2 cm depth of plantings gives highest percent emergence.

Scattered sowing gives greater production than sowing in rows.

Jenkins Summary

For best results, sow crested wheat in the fall at a rate of 1.5 to 2.0 poods per desyatina with a spacing of 12 vershoks between rows - (If you are in a precipitation zone which averages less than 300 mm per year).

MORPHOLOGICAL AND PHYSIOLOGICAL FACTORS AFFECTING THE GRAZING MANAGEMENT OF CRESTED WHEATGRASS

D. N. Hyder and Forrest A. Sneva

Discussion

Crested wheatgrass is somewhat undesirable as a pasture grass because the percentage of reproductive stems usually is large and vegetative stems have culms. Bransom described these characteristics as relatively undesirable in other species. However, tolerance of heavy spring grazing derives from early root-growth activity, early accumulation of leaf tissue, and early accumulation of carbohydrates in the underground parts. These desirable physiological characteristics can be used to advantage when crested wheatgrass seedings provide spring grazing and permit delayed grazing on native species that are less tolerant of early grazing.

A primary undesirable feature results from the growth of stiff culms that become unpalatable and interfere with subsequent grazing. Practicing spring grazing without attention to stem morpholgy can intensify this problem because leafless culms are less palatable and nutritious than fully-developed, leafy ones. At best, full-grown crested wheatgrass is unpalatable to cattle unless vegetative stems predominate. The desirable characteristics of crested wheatgrass can probably be used to advantage, and the undesirable characteristic of stemminess minimized, by grazing to produce either one or two crops of stems in a single season. With favorable growing conditions, a palatable and desirable forage can even be produced for late-summer or fall grazing.

At the study location in Oregon, one-crop management would involve grazing from about May 20-25, when the heads are in boot, until about July 1, when the spikelets are in anthesis. An average stocking rate would be about 1 to 2 acres per cow. One-crop grazing would be expected to (a) permit maximum root growth, (b) harvest maximum amounts of dry matter, crude protein, phosphorus, and potassium, and (c) depress autumn-storage concentrations of carbohydrates in the underground parts - more in dry years than wet ones. Nitrogen fertilization would facilitate one-crop grazing by increasing herbage and nutrient yields and carbohydrate-storage concentrations.

Two-crop management would require grazing beginning about May 1, when the leaves are 6 inches high, and the adjustment of stocking rate to achieve very close grazing about May 20-25, when the heads are in the boot. An

average stocking rate would be about 3 to 4 acres per cow. A second crop of stems would initiate growth after May 20-25. Second-crop herbage could be grazed as needed in late summer or fall, but should not be grazed until fully cured. Its leafy growth and favorable crude-protein content make it very palatable to cattle and fairly nutritious, considering the lack of green forage in late summer. In dry seasons, there would be but little or no second-crop herbage; however, a lack of herbage in the summer seems more desirable and less detrimental to the plants than the growth of leafless culms, as can result from lighter grazing in May. Two-crop grazing would be expected to (a) depress root growth slightly, (b) harvest a maximum of earliest feed, (c) reduce total herbage production, (d) permit high storage concentrations of carbohydrates, and (e) provide some palatable late-summer or fall forage. It is concluded elsewhere that nitrogen fertilization should not be employed prior to two-crop grazing, or to facilitate earlier grazing and higher early-spring stocking rates, because of greater spring carbohydrate mobilization and lower yield returns than when employed prior to late-spring grazing.

For a longer grazing season, crested wheatgrass could be grazed continuously from the time leaves are 6 inches high (earlier grazing can depress root growth severely) until anthesis, but a rotation combination of 2-crop and 1-crop grazing might be more advantageous. With, for example, 3 pastures of equal size, 2 of them grazed in May for 2-crop production would carry about as many animals as 1 of them would carry in June under 1-crop grazing. Although a given pasture might be grazed for either 1 or 2 crops on a reasonably permanent basis, a rotation plan among years, as illustrated below, might facilitate better management and higher production.

Year	Pasture A	Pasture B	Pasture C
1	1 crop	2 crops	2 crops
2	2 crops	1 crop	2 crops
3	2 crops	2 crops	1 crop

These schedules are suggested on a theoretical basis for the grazing management of crested wheatgrass. It remains to be seen where and to what extent these schedules can be realized on a practical basis or whether cultural practices such as fertilization and limited irrigation will be needed to facilitate them.

CONTRASTING EFFECTS OF BIG SAGEBRUSH AND RUBBER RABBITBRUSH ON PRODUCTION OF CRESTED WHEATGRASS

Neil C. Frischknecht
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Summary and Conclusions

Removal of big sagebrush plants in mid-April 1957 increased grass yields by July 16 about 20 percent. Early removal of rubber rabbitbrush had little effect on grass yields. Numbers of grass seed heads increased about 20 percent following early removal of both brush species, but culm height was about two inches shorter.

In each of three years, grass yields were greater under rabbitbrush plants than under sagebrush plants. The effect of size of brush on grass yields was inconclusive in two of the years when cages restricted plot size. More intensive study in the third year showed that grass yields per unit area increased as rubber rabbitbrush crown diameters exceeded 15 inches. The increase was greatest within a one-foot radius from brush stems, but it extended to the two-foot radius when brush crown diameter approached 35 inches. In contrast, grass yields usually decreased as crown diameter of sagebrush plants reached about 15 inches. Sagebrush influenced grass yields markedly to the three-foot radius in large plants.

Depressed yields of grass around big sagebrush plants are associated with highly developed lateral brush roots in the grass-root zone. In contrast, relatively few lateral roots of rubber rabbitbrush occur in this zone. Also, the most active growth periods of crested wheatgrass and big sagebrush coincide, whereas crested wheatgrass makes most of its growth prior to the most active growth of rubber rabbitbrush.

The presence of rabbitbrush improved fall grazing because the understory grass remained more succulent and fall regrowth was more abundant under rabbitbrush than in the open or near sagebrush. Control of big sagebrush on crested wheatgrass range for cattle is a worthwhile objective. Just how much effort is justified in controlling rubber rabbitbrush is questionable, particularly where fall grazing is practiced.

NOTES FROM GROUP DISCUSSIONS

It was pointed out that BLM seedings are primarily for early spring use. However, under this procedure we may be sacrificing maximum production and utilization. On the other hand, BLM's seedings were established for the principle purpose of providing early spring forage to relieve outside native range, and this objective is being achieved. The rancher, who may be able to operate somewhat differently, can utilize seedings to achieve maximum production and utilization.

Question was raised as to whether seedings were expendable. Can the value of a seeding establishment be utilized and lost through excessive grazing to accomplish objectives of adequate rest on outside range? It was debated that such was economically feasible and that the values of delayed use on native ranges and the availability of early spring feed for the livestock operator who must remove his livestock from his meadows exceeded any values for re-establishment. Others, however, considered that the value of public monies obligated to initiate seedings was too great to sacrifice by poor management. It was also opinioned that cases where sacrifice was necessary would be rare, though on occasion when circumstances so required, sacrifice of a seeding would be economically justifiable. Seedings can be re-established generally much easier than native ranges can be rehabilitated.

Should all seedable areas be seeded? It was noted that in the Vale Project they anticipate seeding between 10-15 percent of the total land area. Thus the 10 percent of seeded lands would have a very vital effect on restoration of much of the remainder. Several other considerations might have to be made when considering that all suitable sites should be seeded. These might include the development of other species better adapted to mid-summer livestock use, or forage suitable for wildlife habitat and forage. Degree of degeneration would be a consideration - on those areas where no natural revegetation would occur over a moderate period even under intensive management, artificial rehabilitation would be necessary.

The question was posed as to whether crested wheatgrass could be grazed out. It was the opinion that this can and has been done in a number of instances. Therefore, there must be limitations as to the extent and type of use made on seeded lands.

There was discussion as to whether there was a real need for utilization studies in management of crested wheatgrass seedings. The majority of opinion expressed considered that utilization determinations were necessary for adequate management. It was noted that in the Benmore, Utah studies, stubble heights on the moderately used pastures (60-65 percent) were between 2-plus inches and 4-plus inches, averaging 2.8 inches during the spring growing season.

Regarding longevity of crested wheatgrass seedings - many U. S. seedings are now over 25 years old and still productive. Some studies have shown that production fell off sharply after 4th or 5th year - young stands are more vigorous than old.

Application of nitrogen may occasionally be a good practice in older crested wheatgrass stands.

Production varies widely from year to year depending on precipitation on some sites as much as 5 times from good to poor years.

It was the general concensus that crested wheatgrass is not the most desirable plant to resist run-off; that for erosion control, sod-formers are much better for watershed or swale areas. That litter may increase height growth of crested wheatgrass plants but not production.

The following remarks were made in comparitive discussion of Fairway vs. Standard crested wheatgrass:

Fairway is superior at higher elevations in both production and ground cover.

Fairway stands heavier grazing with less tendency toward wolfiness.

Fairway is better than Standard in Utah above 7000 ft. and in Oregon above 5000 ft.

Fairway shows greater response to late spring precipitation. Is probably less competitive with sagebrush than Standard.

Fairway stands are more difficult to plow than Standard.

Fairway makes a better sod than Standard.

On use of commercial fertilizer on crested wheatgrass seedings, there has been little response except at high rates of application in wet years. Generally is too expensive.

Crested wheatgrass seedings offer an excellent source of spring grazing for which there is a great need in the west. Substantial saving in hay is made from use of crested wheatgrass seeding in the spring. From the standpoint of most livestock operators this spring need is of high priority.

As to intensity of use - light use is not recommended. Start grazing new stands of crested wheatgrass the year following the first crop of seed produced. According to Benmore studies because of its lateral root system, sagebrush competes more with crested wheatgrass than does rabbitbrush. Sagebrush invades faster where crested wheatgrass seedings are heavily utilized in the spring of the year. Heavy fall use of crested wheatgrass may impede brush invasion.

SUMMARY STATEMENT

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Summarization of a conference such as this is rather difficult. It is quite difficult to summarize a conference without being redundant. For this reason, I have chosen to take a little different tack and to make what I would call an interpretive summary of what has taken place here in the last 3 days. Many points have been touched on, many things intimated that could and probably should be pulled together and expanded. I will make an attempt to do this.

At the beginning of the conference Mr. Garth Rudd gave an excellent presentation on the value of crested wheatgrass and its contribution to the range improvement program in western United States, and the stage was set for the beginning of this seminar concerning the management of crested wheatgrass.

Mr. Art Sawyer, Superintendent of the Squaw Butte Experimental Range, pointed out that range management is a biological science which includes both the arts and science. He pointed out that while range management leans heavily toward the art, it must base this art upon scientific facts and experience in their application. It was further pointed out that experiences not based on scientific facts may be improperly interpreted when we attempt to use the information in other places.

He further pointed out that it was absolutely necessary for all of us to budget time to attain and/or maintain professional competency. This should be an important concern to us both as individuals and to the various agencies. Certainly, without individual and agency competency, we can hope to make little progress in the field of range management.

Professional competency, of course, can be increased by many methods such as reading, involvement in professional societies, conferences such as this, workshops, in-service trainings, etc. None of us should miss the opportunities to participate in any of these or other opportunities to keep on top of our job professionally. While our various agencies have the responsibility to encourage us to be professionally competent, there is also a high degree of individual responsibility involved.

Since professionalism is of such major importance to all of us, we must never miss the opportunity to encourage professionalism in our junior staff members. All of us should take real pride in trying to develop

every young man under our influence into a better man, professionally and otherwise, than we are. We must encourage the inquisitive mind. We must encourage the man who wants to know what is behind our directions, what is behind our memorandums, what is behind the orders which we give him. We must encourage our men to think and not just blindly accept what is in the book.

We must also remember that we are technicians, but we should not forget the human relations aspects that are involved in getting a job of range management accomplished. We should be careful never to subjugate professionalism to outside pressures or to political expediency. As technicians and professional range managers, many times we will find that our recommendations may not be accepted by our administrators or by our politicians. However, we must accept this fact, and go ahead and carry out the programs which we are directed to, but we should stand firm on our basic principles, if they are based on scientific fact, and not prostitute our range profession or yield to these outside pressures.

It should be obvious to all of us from the material presented by the people on this program that range management is a thinking job. It is a complex job which involves the integration of many fields of knowledge. There is a great variation in the range itself. That is, our western range is variable from the low plains through the deserts to the foothills. There are many sites or combinations of vegetation and environmental factors with which we must be concerned. Each may respond differently to grazing use or to other manipulations. To the best of our ability we must understand these sites and their responses. We must then manipulate factors, which we can manipulate, to bring about the desired results. Research and experience have and are continuing to give us information as to what factors we can manipulate and how we can manipulate them to gain desired results.

We can manipulate the season of use, that is, whether the ranges are to be used during fall, summer, etc. We can manipulate length of season, class of livestock, stubble height, percent of utilization; we can manipulate where to seed and what to seed; we can manipulate brush control factors. These are but a few of the factors, but serve to demonstrate the principles involved.

Reseach is attempting to discover basic physiological and ecological principles and show us how they can be adapted to practical range management. While we have been primarily concerned with plant physiology and ecology, it is equally evident that work on both animal physiology and ecology research is being conducted and is furnishing us answers which can be of value in management of the range resource.

Throughout this seminar, there has been some misunderstanding of the terminology which was used. There is not always good communication and understanding of such terms as percent utilization, heavy, light, and moderate use, early grazing season, late grazing season, etc. It is important for us to do the best job of communication we can. We should not get bogged down in sematics, but concern ourselves with the principles involved. If we do this, I believe we will make progress and be able to adapt research to practical range management.

In adapting research to practical range management, it is important not to generalize too broadly. It is evident that a practice may be good or successful in one place, but not in another. This is to be expected if we seriously consider what is involved. We must always consider the full range of ecological factors involved in the management of any range site. This includes both soil and vegetation and other considerations. We must also keep in mind and foremost in our considerations, the needs of the resource user. As managers of public domains, the needs of the users should be kept in mind, but I fear they are sometimes overlooked in the overall management planning. Throughout this conference, it seems to me that the word ecology has been played down or ignored. It should be of little surprise to us that researchers in the different areas, that is, Nevada, Idaho, Oregon, and Utah obtain different results from studies in their respective areas. This should be so, as they are studying crested wheatgrass and its response to the different ecologic sites as well as to different treatments which were applied to it. A more surprising thing would have been if they had obtained similar results from similar treatments in these widely varying ecologic sites.

I believe that as a broad conclusion from the research information presented during this conference that we could say (1) crested wheatgrass is a very good grass with wide ecologic amplitude (2) crested wheatgrass has a wide season of use (3) crested wheatgrass can be utilized heavily and survive (proper utilization and longevity of the grass appear to be moot questions) (4) responses of crested wheatgrass to use varies greatly with site (5) crested wheatgrass can be used by many classes of livestock (6) proper management (and who is to say what is proper) is essential for satisfactory production (7) there are definite varietal differences in crested wheatgrass (8) there are no cut and dried answers available for proper management of crested wheatgrass (9) crested wheatgrass will continue to be an important and challenging aspect of range management and (10) there are apparently many other conclusions that could be drawn which would be equally as appropriate.

In a broader sense, it would seem to me it is important to discuss a bit on how seeding of crested wheatgrass or any other improvement practice fits into overall phases of range management. It is important to realize

that any range improvement practice in itself is not range management, but is only a part of range management. It is equally apparent that a management plan for an entire range management unit, must precede any range improvements if the resource is to be developed and managed wisely. We must know in which direction we are going. We must, however, understand the resource in order to know directions we should go. In order to develop an overall management plan, we must first know and understand the available resources. This understanding must be based on an understanding and proper interpretation of the ecological factors involved.

We must also know the needs of the resource user. We must know when the forage is needed, what kind of animal is going to be used, and we must not forget that the total management unit must provide a year-around feed supply for the grazing animals.

It is very difficult for me to see how we can approach the problem of range improvement and management without full consideration of this "unit management" concept, regardless of whether we are talking about public or private lands or a combination of both. In most cases in the considerations we have made the last 2 or 3 days, we have probably been talking about combinations of both public and private lands.

Within this concept, we should probably put our first improvement dollar where it will do the most good, that is, within the assumption stated above, we should probably improve areas first that have the greatest potential. We should plan the use and the management of the areas before improvements are started. To me, it seems a wide departure from professionalism in range management to postpone management plans until a certain improvement, such as crested wheatgrass seedings, are successfully established.

In planning the management of any resource area, we must not become a slave to any management system. A management system is only a tool to accomplish desired ends. The system must remain flexible. Systems must be developed to fit the resource and the needs of the user. We should not attempt to adapt the resource to the system or take a preconceived system and try to make it work on all resources. To the contrary, we should understand the resource and then try to develop a system or method of management in order to achieve the desired ends.

In planning for the management of the range and related resources, we must keep in mind all of the people who are involved. We must keep foremost in mind that we are planning to serve human needs, not just for management sake or just to provide us with jobs. In our civilization, I believe, we have accepted the premise that the human being is all important. We must then keep in mind and give serious consideration to how our management plans are adapted to the ultimate purpose of serving human beings.

There has been some disagreement throughout the conference on some points. However, I believe these disagreements were primarily on specifics and there has been little if any disagreement on principles. However, I think we must keep in mind that there is a great need for honest, critical, professional disagreement. We must remember that whenever everyone agrees all the time, it is an indication that only one is doing the thinking. I think this is an especially important point with those of us who have people under our supervision. It may flatter our ego to have people agree with us all the time. However, we must never forget that most of the progress in this world has been made by those who chose to ask questions and who chose to be different. I do not mean to intimate that we should encourage people to be different for difference sake or to disagree for the sake of disagreeing, but we should encourage people to think and to question critically.

This entire job of resource management involves a big job of education for all of us. I think it is necessary for us all to help educate others in matters of range and related resource management. I think it is also extremely necessary that we first educate ourselves. We should not under any circumstances assume that because we have somehow earned or been granted a degree after completion of 4 years of academic work that we are educated. But, we should hope that this has placed us in a position where we can begin to be educated. A primary mark of an educated man is that he continues to learn and think critically.

This seminar, in my opinion, has been an excellent example of cooperation between a variety of agencies. Let's not stop here. This seminar will prove to be of limited value if we cooperate here and give lip service only to cooperation the remainder of the year. I think it is imperative that we get together as groups or individuals when needed, where needed, to work together for better resource management. We should keep in mind, I believe,that there is more to be done than we can all accomplish in a life time. Let's not fear that asking for help or consultation is a sign of weakness, when really it is a sign of strength and a reflection of an objectivity and breadth of thinking.

I would like to thank Howard DeLano and others in the Bureau of Land Management for making this conference possible and for allowing me and other members of the Oregon State University Extension Service to participate in it.

We at Oregon State University realize the importance of the contribution of range resource to the economy of the state. We want to, and can, I believe, contribute to its continued development and management.

I would personally like to thank each of the panel members who participated in this seminar; Mr. Neil Frischknecht, Dr. Joe Robertson, Mr. Lee Sharp,

Mr. Joe Mohan, and Mr. Bill Anderson. Each of you, I believe, have contributed to our knowledge collectively and individually. If we do our job as well as you have done yours, it should be reflected in attitudes and actions, and range management in Oregon should be the better off for it.

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